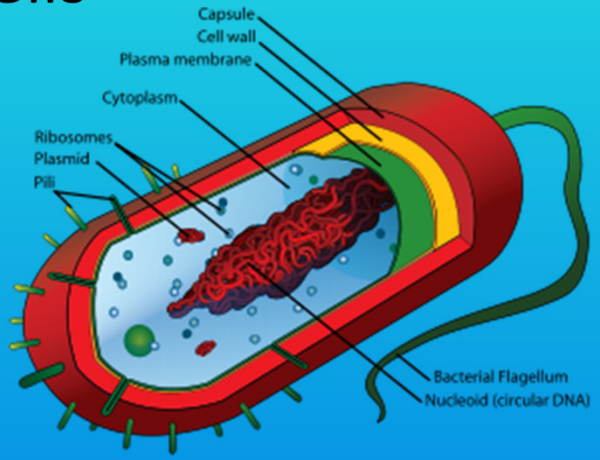
CELL STRUCTURE AND FUNCTION

Chapter 7

Ch 7.1: Life is Cellular

- ***Cell*** = Basic unit of life
- All cells have
  - ***Cell membrane*** =
    - Thin, flexible barrier surrounding cell
    - Controls what enters and leaves cell
  - ***Cytoplasm*** =
    - Jelly-like fluid inside cell
  - ***Ribosomes*** =
    - Site of protein synthesis
    - Found throughout cytoplasm
  - DNA
    - Genetic material of the cell

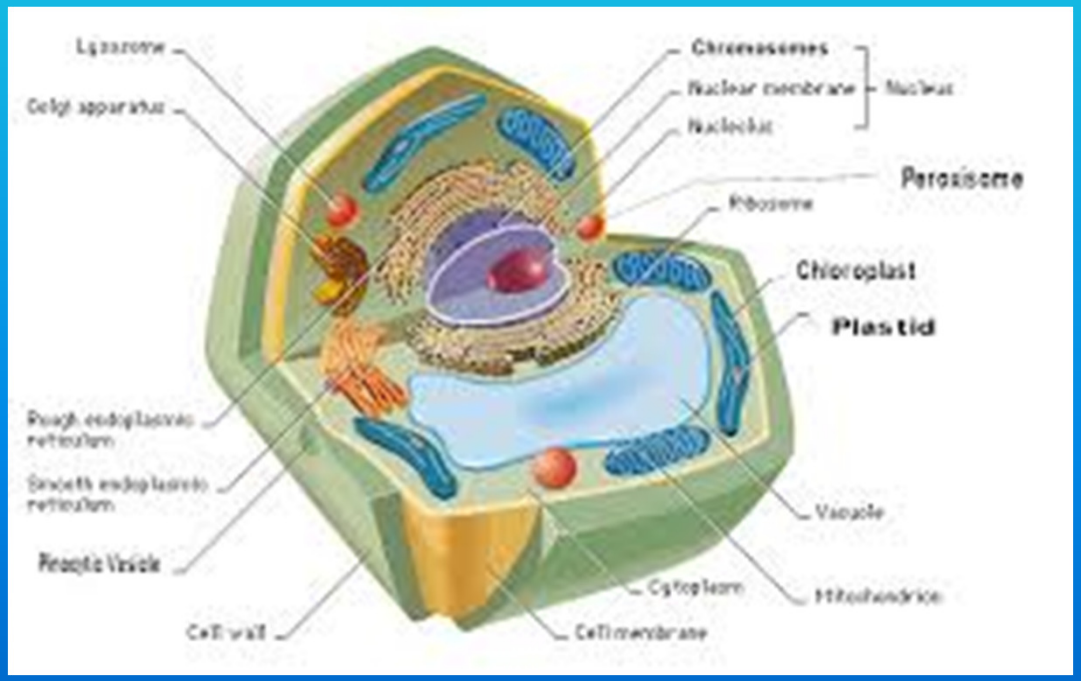
- ***Prokaryotes*** =
  - Unicellular organisms that lack a nucleus
  - DNA is found in cytoplasm
  - Generally smaller and simpler cells
  - Ex: Bacteria

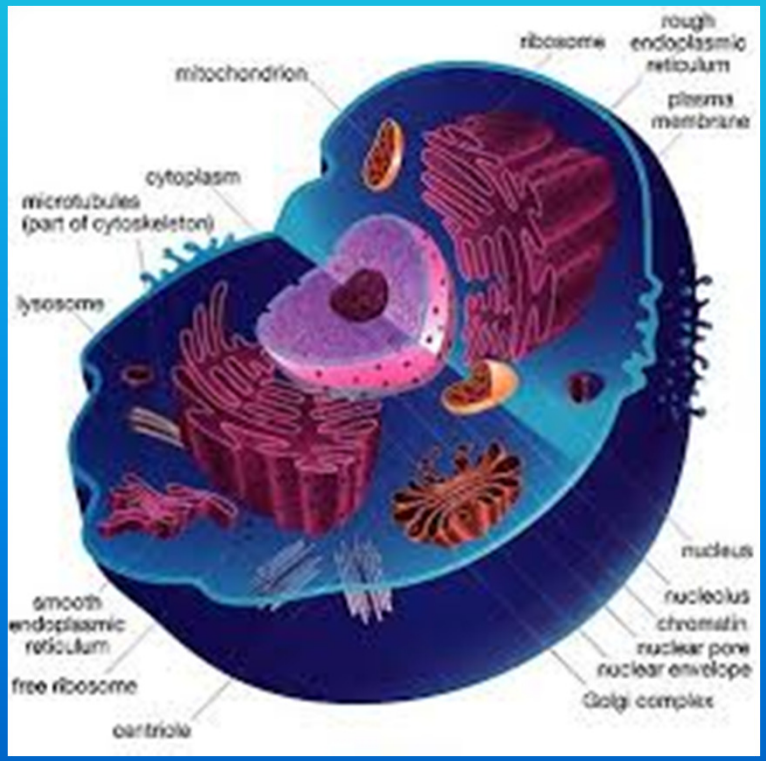


- ***Eukaryotes*** =
  - Cells contain a nucleus
  - DNA is enclosed within nucleus
  - Generally larger and more complex
  - Ex: Protists (unicellular);
    Fungi, Plants, Animals (multicellular)

Ch 7.2: Cell Structure

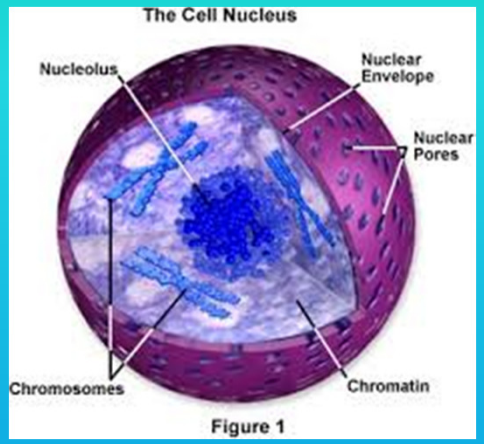
- ***Organelle*** = specialized part of a cell that performs specific functions





Cellular Control Center

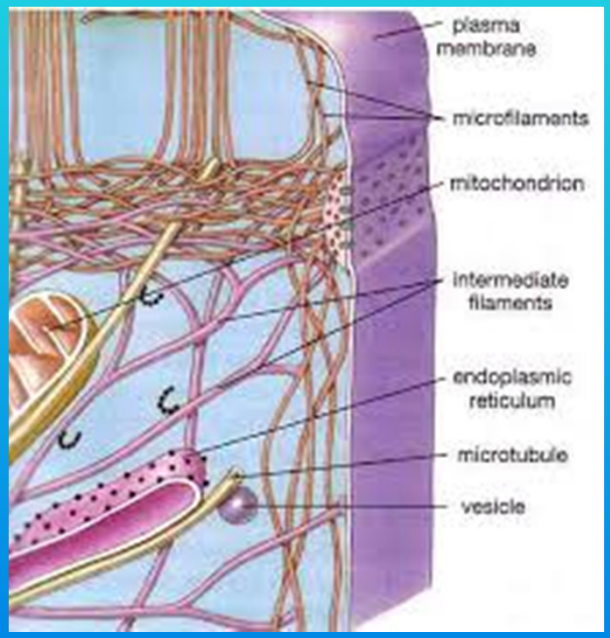
- ***Nucleus*** =
  - Control center of the cell
  - Contains ***chromosomes*** =
    - Carry genetic information (DNA)
  - Surrounded by a ***nuclear envelope*** =
    - Controls what moves into and out of nucleus
  - Contains ***nucleolus*** =
    - Manufactures ribosomes



Store, Clean, Support

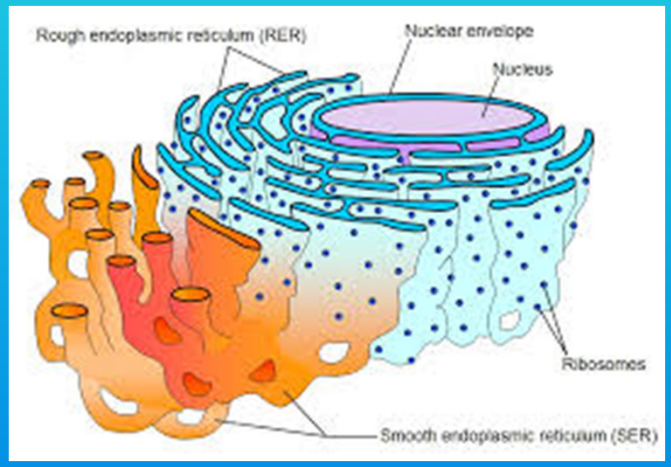
- ***Vacuoles*** =
  - Store water, salts, proteins, and carbohydrates
  - Plants: Large central vacuole
- ***Vesicles*** =
  - Store and move materials between organelles and cell surface
- ***Lysosomes*** =
  - Vesicles containing digestive enzymes that clean up the cell
  - Typically found only in animal cells

- ***Cytoskeleton*** =
  - Helps cell maintain shape
  - Involved in movement of and within cell
  - Consists of
    - Microfilaments
    - Microtubules
      - Form components of cilia and flagella
      - In animal cells, form ***centrioles*** =
        - » Facilitate movement of chromosomes during cell division

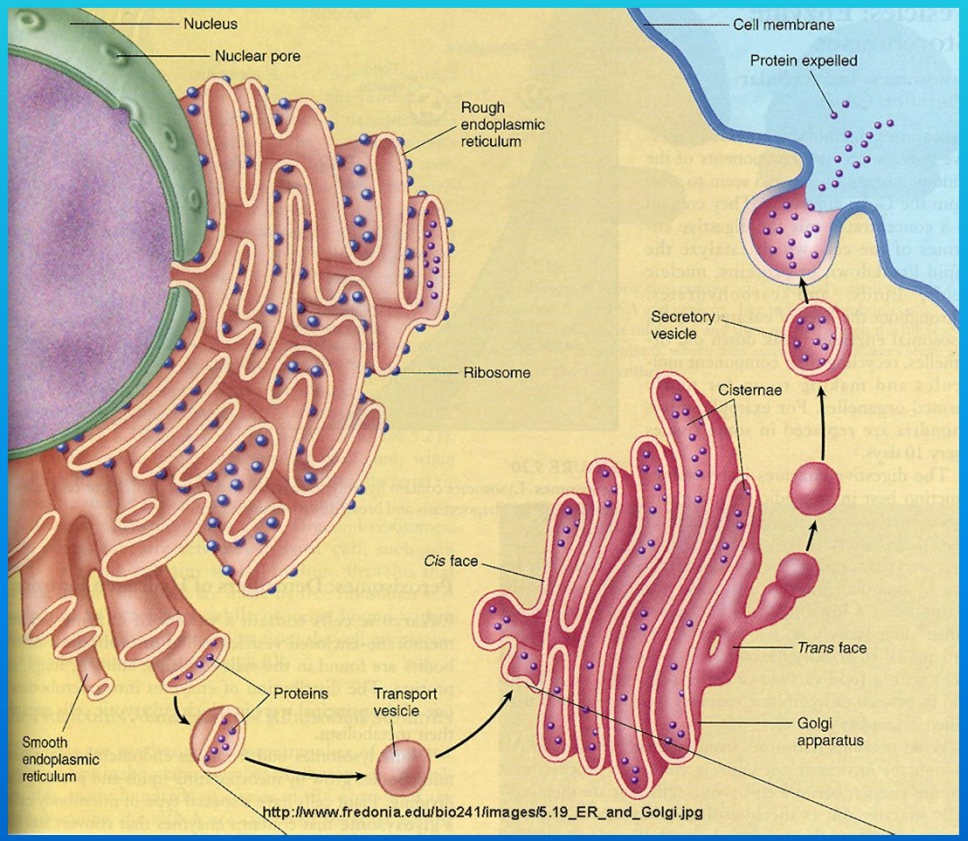


Build Proteins

- ***Ribosomes*** =
  - Proteins are produced here
  - Found attached to rough ER or free in the cytoplasm
- ***Endoplasmic reticulum*** =
  - Internal membrane system that transports lipids and proteins
  - Rough ER has ribosomes attached to it
    - Exports proteins
  - Smooth ER does not have ribosomes
    - Involved in lipid synthesis and detoxification of drugs

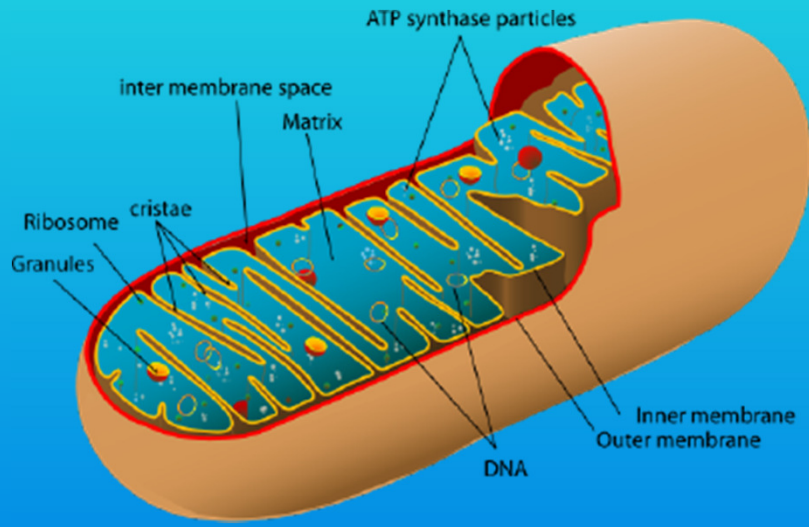


- ***Golgi apparatus*** =
  - Modifies, sorts, and packages proteins and lipids from the ER



Capture and Release Energy

- ***Chloroplasts*** =
  - Convert energy from sunlight into chemical energy (glucose) through photosynthesis
  - Found in plants
- ***Mitochondria*** =
  - Convert chemical energy from food into ATP during respiration
  - ***Cristae*** =
    - Numerous folds of the inner membrane
    - Increase surface area to produce more ATP

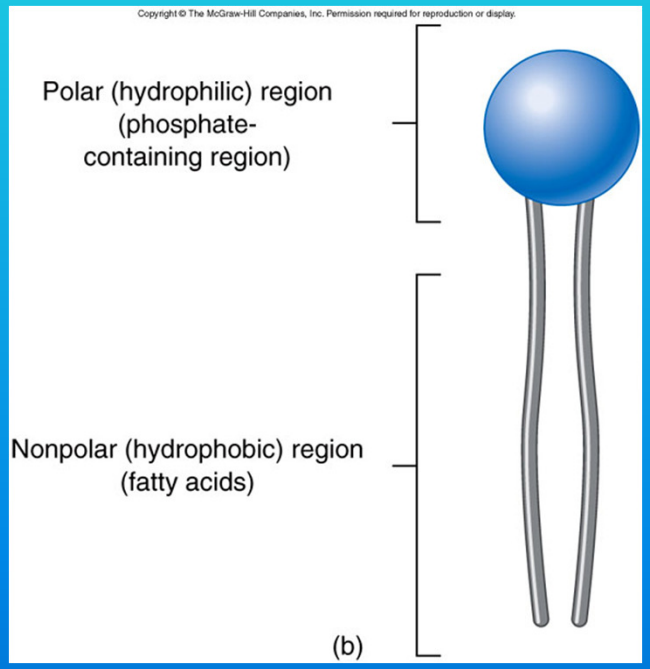


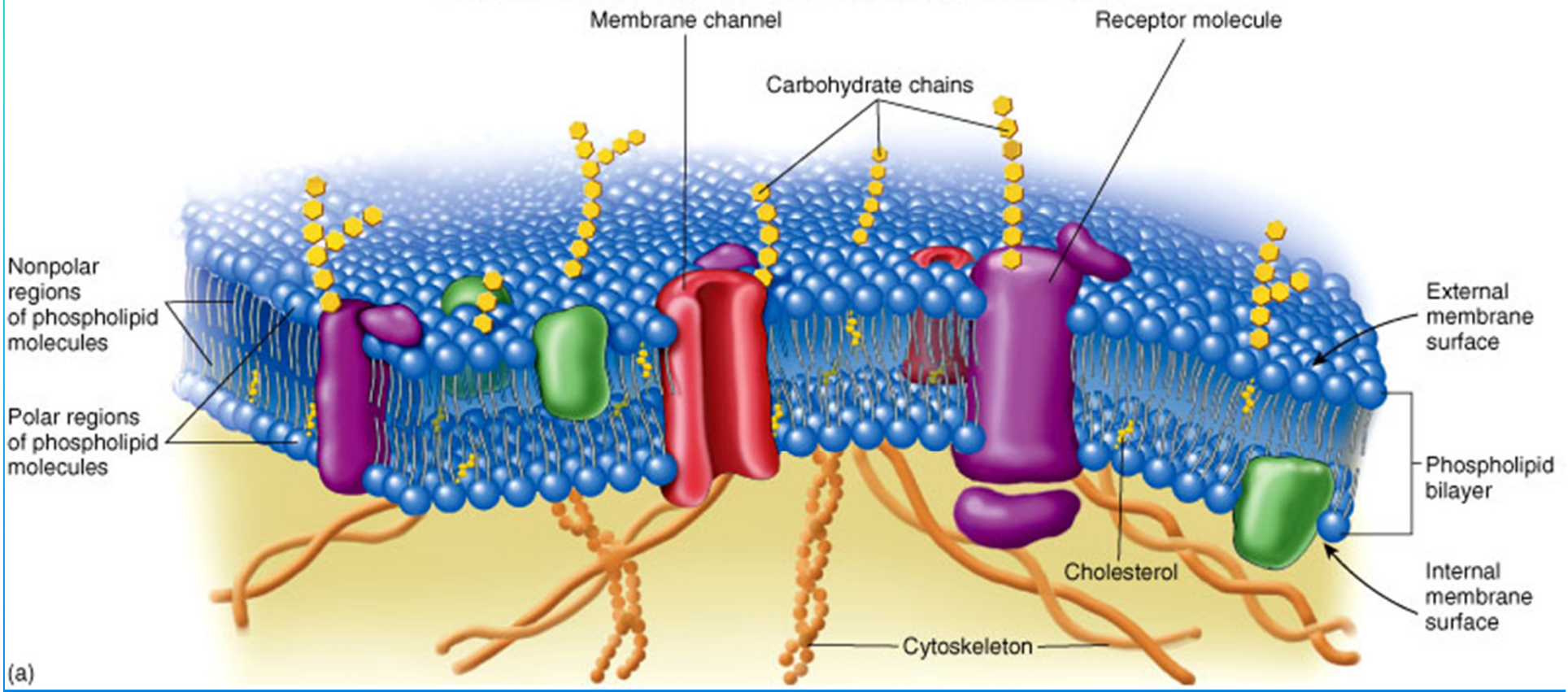
- Both organelles contain their own unique type of DNA

Cellular Boundaries

- ***Cell wall*** =
  - Supports, shapes, and protects cell
  - Found in prokaryotes and plant cells
  - NOT found in animal cells
- ***Cell membrane*** =
  - Protective barrier that regulates what enters and leaves cell
    - Selectively (or semi) permeable
  - Composed of lipid bilayer

- Fluid Mosaic Model
  - Cell membrane contains a double layer of phospholipids
    - Phosphate "head" is polar and is attracted to water
      - ***Hydrophilic*** =
        - » Water loving
    - Fatty acid "tails" are nonpolar and are repelled by water
      - ***Hydrophobic*** =
        - » Water fearing
  - Also contains proteins and carbohydrates





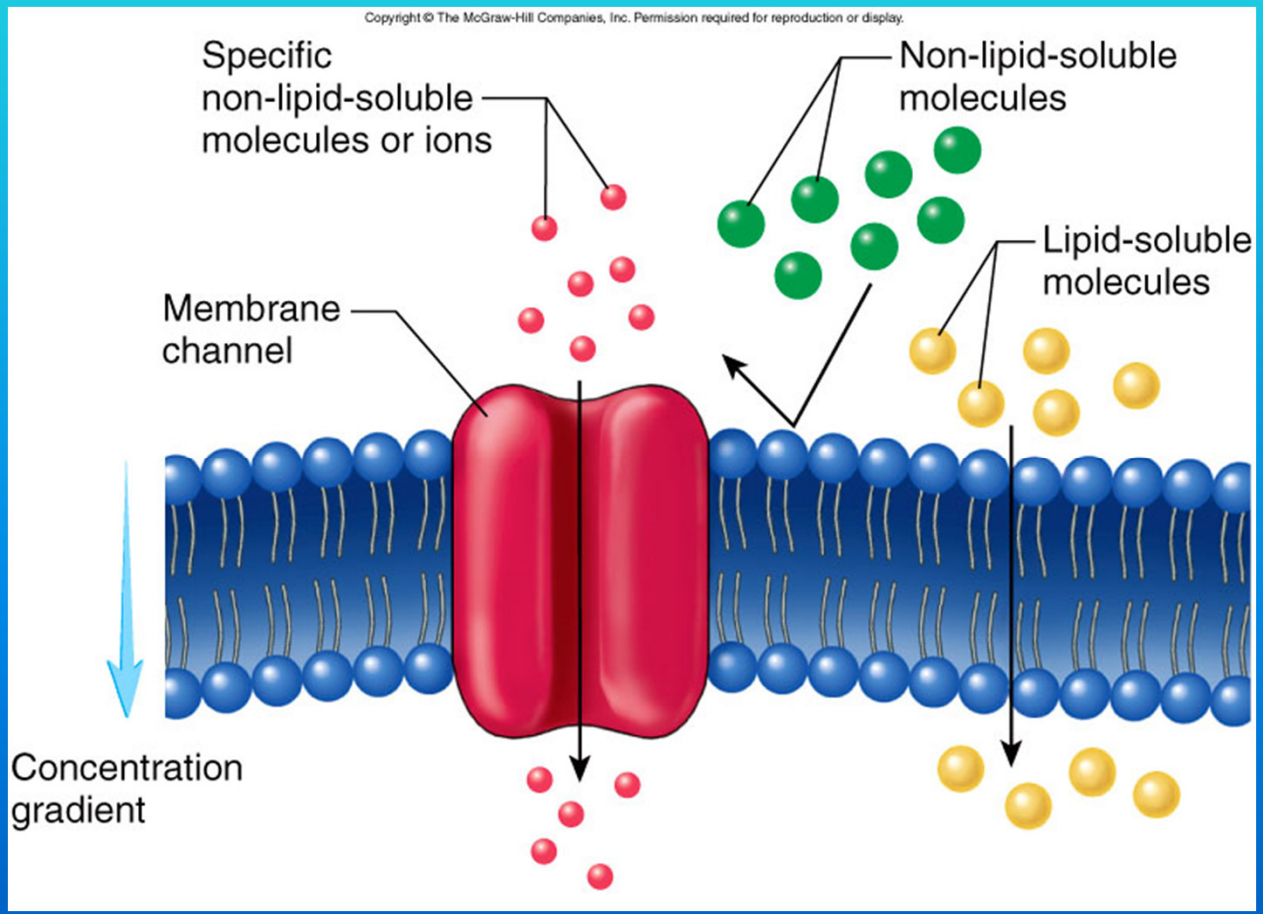
Ch 7.3: Cell Transport

- ***Passive Transport*** =
  - Movement of materials across cell membrane from ***high to low*** concentration
  - Does NOT require energy

1. ***Diffusion*** =
   - Movement of solute from ***high to low*** concentration
   - At ***equilibrium*** the NET movement of solutes stops, although the random motion continues

2. ***Facilitated diffusion*** =

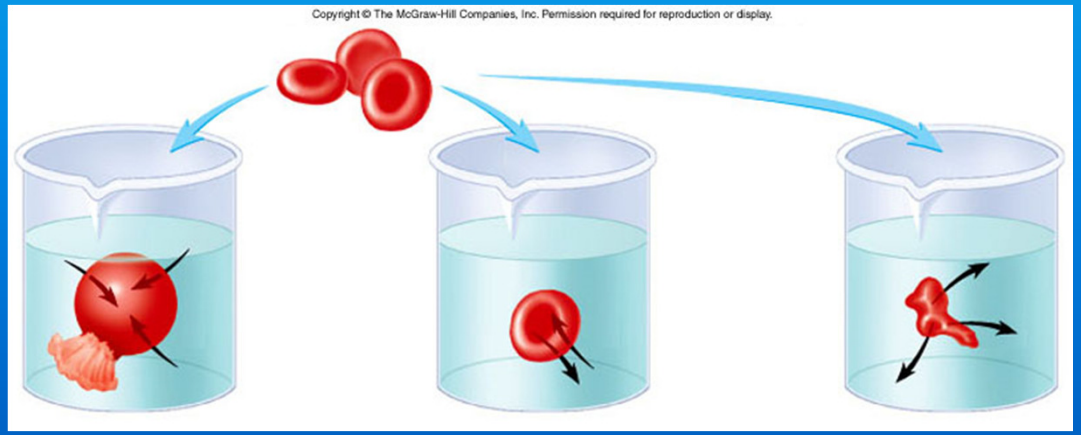
- Molecules pass from ***high to low*** through membrane channels



3. ***Osmosis*** =

- The diffusion of water across a selectively permeable membrane
- Water moves from ***high to low***

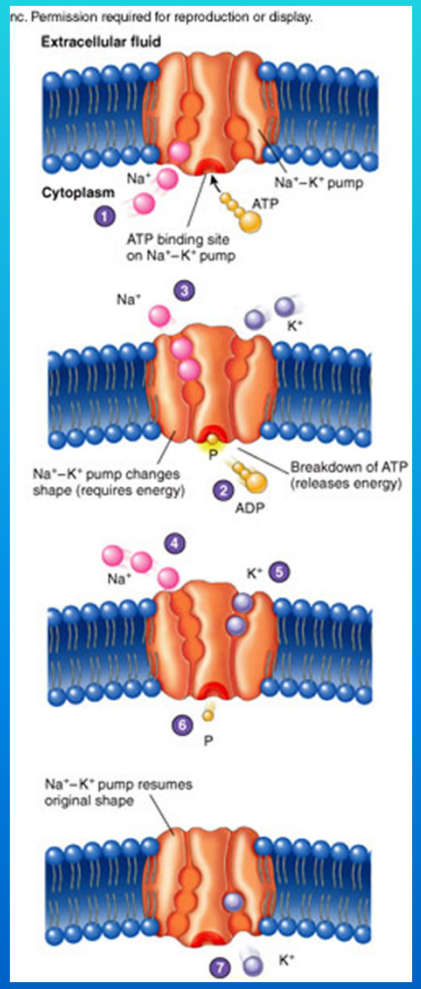
- ***Isotonic solution***=
  - Concentrations of solutes and water are the same on both sides of the cell membrane
  - Cells neither swell nor shrink



- ***Hypertonic solution***=
  - Higher concentration of solutes and a lower concentration of water outside the cell
  - Water moves out of the cell
  - ***Crenation*** = cell shrinks
- ***Hypotonic solution***=
  - Lower concentration of solutes and a higher concentration of water outside the cell
  - Water moves into the cell
  - ***Lysis*** = cell ruptures

- ***Active Transport*** =
  - Movement of materials from ***low to high*** concentration
  - Requires ***energy!***

1. Molecular transport via protein pumps
   - ATP provides necessary energy
   - Ex: Sodium-potassium pump
     - Moves Na+ out of cells
     - Moves K+ into cells
     - Results in higher concentration of Na+ outside and higher concentration of K+ inside



2. Bulk Transport

- ***Endocytosis*** =
  - –Taking material into cell through formation of vesicles
  - –***Phagocytosis*** =
    - »Movement of solid materials into cells
  - –***Pinocytosis*** =
    - »Movement of liquid into cells
- ***Exocytosis*** =
  - –Elimination of material from a cell through the formation of vesicles

Transport Moves Substances

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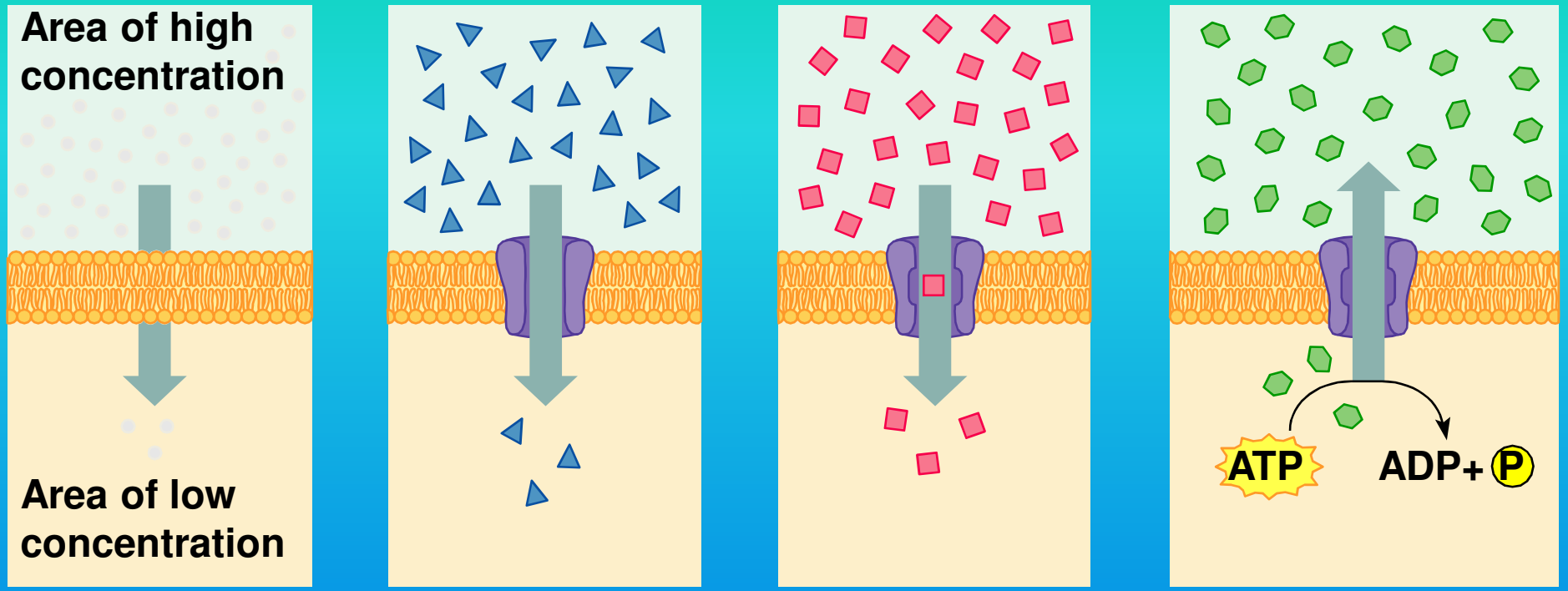

A Simple diffusion

B Facilitated diffusion—channel

C Facilitated diffusion—carrier

D

Passive transport
No energy required

Active transport
Energy required

Endocytosis and Exocytosis

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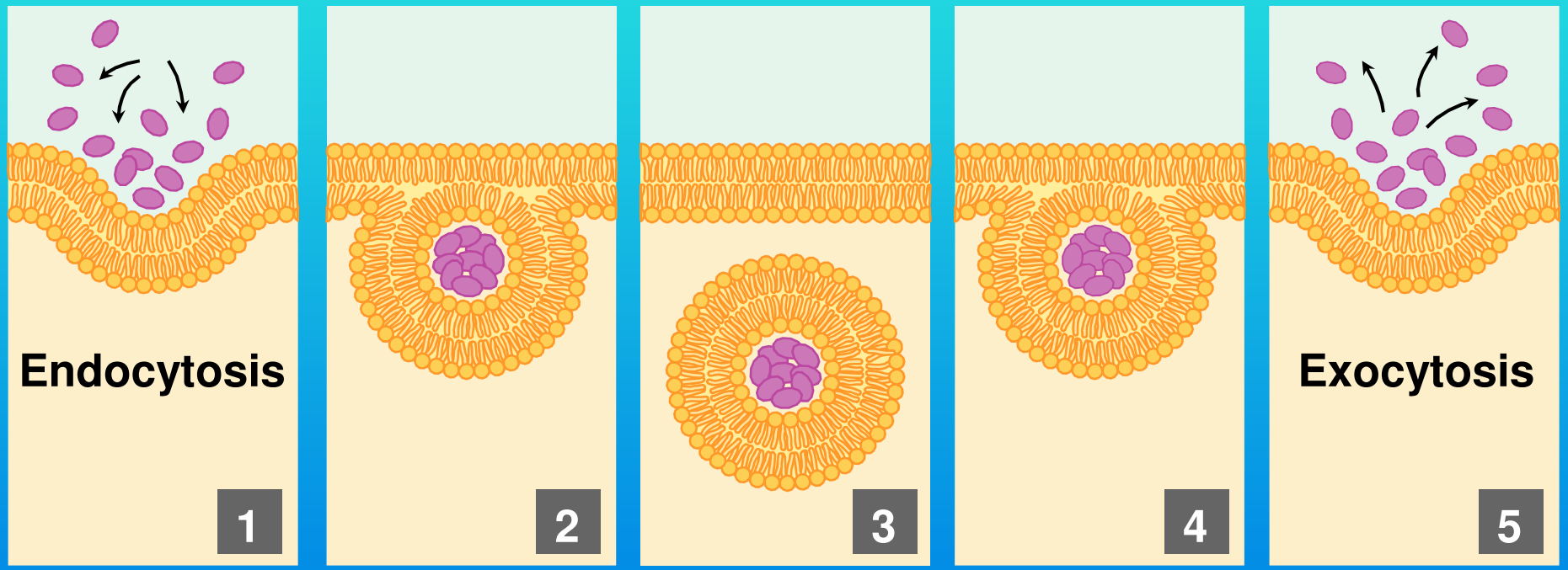

Ch 7.4: Homeostasis and Cells

- ***Homeostasis*** = ("homeo" means "the same")
  - Relatively constant internal physical and chemical conditions that organisms maintain
- To maintain homeostasis
  - Unicellular organisms
    - ~Grow
    - ~Respond to environment
    - ~Reproduce
    - ~Transform energy
  - Cells of multicellular organisms work together
    - Cells are organized into **tissues**
    - Tissues are organized into **organs**
    - Organs are organized into **organ systems**